

Indifference Curve Analysis

This brief appendix contains another explanation of or approach to the theory of consumer behavior. It is based on *ordinal utility* (the rank-ordering of consumer preferences) rather than *cardinal utility* (the precise measurement of utility). For this explanation you are introduced first to the **budget line** and then to the **indifference curve**. These two geometrical concepts are then combined to explain when a consumer is purchasing the combination of two products that maximizes the satisfaction obtainable with his or her income. The last step is to vary the price of one of the products to find the consumer's demand (schedule or curve) for the product.

■ CHECKLIST

When you have studied this appendix you should be able to

- ☐ Distinguish between cardinal utility and ordinal utility.
- ☐ Describe the concept of a budget line and its characteristics.
- ☐ Explain how to measure the slope of a budget line and determine the location of the budget line.
- ☐ Describe the concept of an indifference curve.
- ☐ State two characteristics of indifference curves.
- ☐ Explain the meaning of an indifference map.
- ☐ Given an indifference map, determine which indifference curves bring more or less total utility to consumers.
- ☐ Use indifference curves to identify which combination of two products maximizes the total utility of consumers.
- ☐ Derive a consumer's demand for a product using indifference curve analysis.
- ☐ Compare and contrast the marginal-utility and the indifference curve analyses of consumer behavior.

■ APPENDIX OUTLINE

1. Indifference curve analysis is based on ordinal utility in which consumer preferences are rank-ordered, but not measured. By contrast, the utility-maximization analysis and rule present in Chapter 7 is based on cardinal utility, or the precise measurement of utility or satisfaction.

2. A **budget line** shows graphically the different combinations of two products a consumer can purchase with a particular money income. A budget line has a negative slope.

a. An increase in the money income of the consumer will shift the budget line to the right without affecting its slope. A decrease in money income will shift the budget line to the left.

b. An increase in the prices of both products shifts the budget line to the left. A decrease in the prices of both products shifts the budget line to the right. An increase (decrease) in the price of the product, the quantity of which is measured horizontally (the price of the other product remaining constant), pivots the budget line around a fixed point on the vertical axis in a clockwise (counterclockwise) direction.

3. An **indifference curve** shows graphically the different combinations of two products that bring a consumer the same total utility.

a. An indifference curve is downsloping. If the utility is to remain the same when the quantity of one product increases, the quantity of the other product must decrease.

b. An indifference curve is also convex to the origin. The more a consumer has of one product, the smaller the quantity of a second product he or she is willing to give up to obtain an additional unit of the first product. The slope of an indifference curve is the **marginal rate of substitution** (MRS), the rate at which the consumer will substitute one product for another to remain equally satisfied.

4. The consumer has an indifference curve for every level of total utility or satisfaction. The nearer a curve is to the origin in this **indifference map**, the smaller is the utility of the combinations on that curve. The further a curve is from the origin, the larger is the utility of the combinations on that curve.

5. The consumer is in an **equilibrium position** and purchasing the combination of two products that brings the maximum utility to her or him, when the budget line is tangent to the highest attainable indifference curve.

6. In the marginal-utility approach to consumer behavior, it is assumed that utility is cardinal and it is measurable. In the indifference-curve approach, utility is ordinal and rank-ordered. It need only be assumed that a consumer can say whether a combination of products has more utility than, less utility than, or the same amount of utility as another combination.

7. The demand (schedule or curve) for one of the products is derived by varying the price of that product and

shifting the budget line, holding the price of the other product and the consumer's income constant, and finding the quantity of the product the consumer will purchase at each price when in equilibrium.

HINTS AND TIPS

1. This appendix simplifies the analysis by limiting consumer choice to just two goods. The **budget line** shows the consumer what it is possible to purchase in the two-good world, given an income. Make sure that you understand what a budget line is. To test your understanding, practice with different income levels and prices. For example, assume you had an income of \$100 to spend for two goods (A and B). Good A costs \$10 and Good B costs \$5. Draw a budget line to show the possible combinations of A and B that you could purchase.

2. **Indifference curves** and the marginal rate of substitution are perhaps the most difficult concepts to understand in this appendix. Remember that the points on the curve show the possible combinations of two goods for which the consumer is *indifferent*, and thus does not care what combination is chosen. The **marginal rate of substitution** is the rate at which the consumer gives up units of one good for units of another along the indifference curve. This rate will change (diminish) as the consumer moves down an indifference curve because the consumer is less willing to *substitute* one good for the other.

IMPORTANT TERMS

budget line	indifference map
indifference curve	equilibrium position
marginal rate of substitution (MRS)	

SELF-TEST

FILL-IN QUESTIONS

1. A schedule or curve that shows the various combinations of two products a consumer can buy with a specific (income, feature) _____ is called (a budget, an indifference) _____ line.

2. Given two products X and Y, and a graph with the quantities of X measured horizontally and the quantities of Y measured vertically, the budget line has a slope equal to the ratio of the _____ to the _____.

3. When a consumer's income increases, the budget line shifts to the (left, right) _____, while a decrease in income shifts the budget line to the _____.

4. Given two products, A and B, and a budget line graph with the quantities of A measured horizontally and

the quantities of B measured vertically, an increase in the price of A will fan the budget line (outward, inward)

_____, and a decrease in the price of A will fan the budget line _____ around a fixed point on the (A, B) _____ axis.

5. (A demand, An indifference) _____ curve shows the various combinations of two products that give a consumer the same total satisfaction or total (cost, utility) _____.

6. An indifference curve slopes (upward, downward) _____ and is (concave, convex) _____ to the origin.

7. The slope of the indifference curve at each point measures the (marginal, total) _____ rate of substitution of the combination represented by that point.

8. The more a consumer has of the first product than the second product, the (greater, smaller) _____ is the quantity of the first product the consumer will give up to obtain an additional unit of the second product. As a result, the marginal rate of substitution (MRS) of the first for the second product (increases, decreases) _____ as a consumer moves from left to right (downward) along an indifference curve.

9. A set of indifference curves reflects different levels of (marginal, total) _____ utility and is called an indifference (plan, map) _____.

10. The farther from the origin an indifference curve lies, the (greater, smaller) _____ the total utility obtained from the combinations of products on that curve.

11. A consumer obtains the greatest attainable total utility or satisfaction when he or she purchases that combination of two products at which his or her budget line is (tangent to, greater than) _____ an indifference curve. At this point the consumer's marginal rate of substitution is equal to the (slope, axis) _____ of the budget line.

12. Were a consumer to purchase a combination of two products that lie on her budget line and at which her budget line is steeper than the indifference curve intersecting that point, she could increase her satisfaction by trading (down, up) _____ her budget line.

13. The marginal-utility approach to consumer behavior requires that we assume utility is (cardinal, ordinal) _____, or numerically measurable; the indifference-curve approach assumes the utility is _____ and that preferences are ranked.

14. When quantities of product X are measured along the horizontal axis, a decrease in the price of X

- flattens the budget line (inward, outward) _____ and to the (right, left) _____;
- puts the consumer, when in equilibrium, on a (higher, lower) _____ indifference curve; and
- normally induces the consumer to purchase (more, less) _____ of product X.

15. Using indifference curves and different budget lines to determine how much of a particular product an individual consumer will purchase at different prices makes it possible to derive that consumer's (supply, demand) _____ curve or schedule for that product.

■ TRUE-FALSE QUESTIONS

Circle T if the statement is true, F if it is false.

- The budget line shows all combinations of two products that the consumer can purchase, given money income and the prices of the products. T F
- The slope of the budget line when quantities of Alpha are measured horizontally and quantities of Beta are measured vertically is equal to the price of Beta divided by the price of Alpha. T F
- A consumer is unable to purchase any of the combinations of two products which lie below (or to the left) of the consumer's budget line. T F
- An increase in the money income of a consumer shifts the budget line to the right. T F
- If a consumer moves from one combination (or point) on an indifference curve to another combination (or point) on the same curve, the total utility obtained by the consumer does not change. T F
- An indifference curve is concave to the origin. T F
- The marginal rate of substitution shows the rate, at the margin, at which the consumer is prepared to substitute one good for the other so as to remain equally satisfied. T F
- The closer to the origin an indifference curve lies, the smaller the total utility a consumer obtains from the combinations of products on that indifference curve. T F
- On an indifference map, the further from the origin, the lower the level of utility associated with each indifference curve. T F
- There can be an intersection of consumer indifference curves. T F
- A consumer maximizes total utility when she or he purchases the combination of the two products at which her or his budget line crosses an indifference curve. T F
- On an indifference map, the consumer's equilibrium position will be where the slope of the highest attainable indifference curve equals the slope of the budget line. T F

13. It is assumed in the marginal-utility approach to consumer behavior that utility is cardinal, or numerically measurable. T F

14. In both the marginal-utility and indifference curve approaches to consumer behavior, it is assumed that a consumer is able to say whether the total utility obtained from combination A is greater than, equal to, or less than the total utility obtained from combination B. T F

15. A decrease in the price of a product normally enables a consumer to reach a higher indifference curve. T F

■ MULTIPLE-CHOICE QUESTIONS

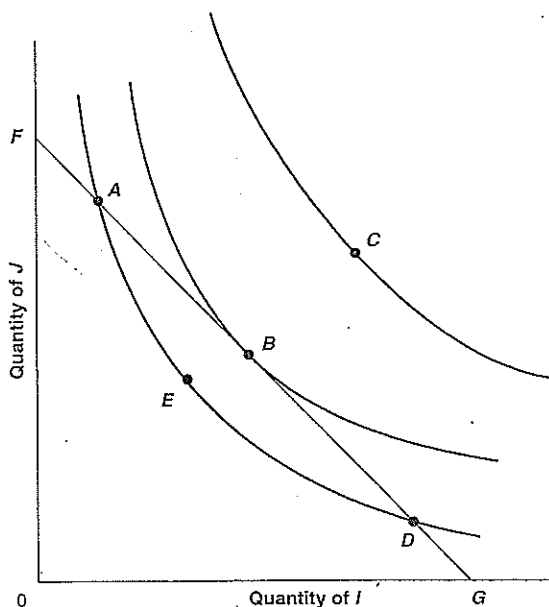
Circle the letter that corresponds to the best answer.

- Suppose a consumer has an income of \$8, the price of R is \$1, and the price of S is \$0.50. Which of the following combinations is on the consumer's budget line?
 - 8R and 1S
 - 7R and 1S
 - 6R and 6S
 - 5R and 6S
- If a consumer has an income of \$100, the price of U is \$10, and the price of V is \$20, the maximum quantity of U the consumer is able to purchase is
 - 5
 - 10
 - 20
 - 30
- When the income of a consumer is \$20, the price of T is \$5, the price of Z is \$2, and the quantity of T is measured horizontally, the slope of the budget line is
 - 0.4
 - 2.5
 - 4
 - 10
- Assume that everything else remains the same, but there is a decrease in a consumer's money income. The most likely effect is
 - an inward shift in the indifference curves because the consumer can now satisfy fewer wants
 - an inward shift in the budget line because the consumer can now purchase less of both products
 - an increase in the marginal rate of substitution
 - no change in the equilibrium of the consumer
- An indifference curve is a curve that shows the different combinations of two products that
 - give a consumer equal marginal utilities
 - give a consumer equal total utilities
 - cost a consumer equal amounts
 - have the same prices
- In the following schedule for an indifference curve, how much of G is the consumer willing to give up to obtain the third unit of H?
 - 3
 - 4
 - 5
 - 6

Quantity of G	Quantity of H
18	1
12	2
7	3
3	4
0	5

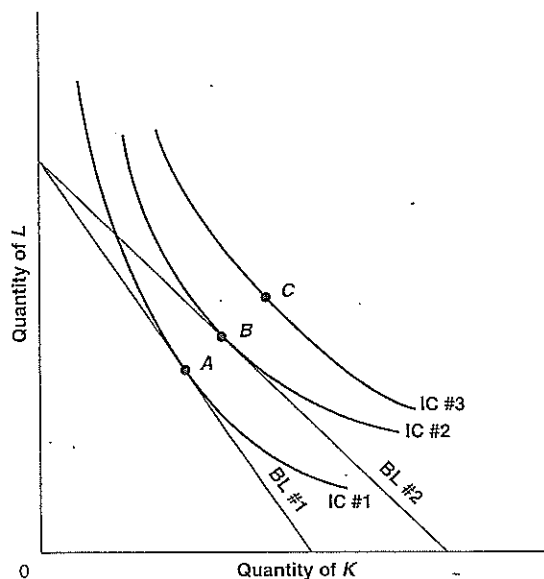
7. The slope of the indifference curve measures the
- slope of the budget line
 - total utility of a good
 - space on an indifference map
 - marginal rate of substitution
8. The marginal rate of substitution
- may rise or fall, depending on the slope of the budget line
 - rises as you move downward along an indifference curve
 - falls as you move downward along an indifference curve
 - remains the same along a budget line
9. Which of the following is characteristic of indifference curves?
- They are concave to the origin.
 - They are convex to the origin.
 - Curves closer to the origin have the highest level of total utility.
 - Curves closer to the origin have the highest level of marginal utility.
10. To derive the demand curve of a product, the price of the product is varied. For the indifference curve analysis, the
- budget line is held constant
 - money income of the consumer changes
 - tastes and preferences of the consumer are held constant
 - prices of other products the consumer might purchase change

Questions 11, 12, 13, and 14 are based on the diagram below.



11. The budget line is best represented by line
- AB
 - AD
 - FG
 - DG
12. Which combination of goods I and J will the consumer purchase?
- A
 - B
 - C
 - E
13. Suppose the price of good I increases. The budget line will shift
- inward around a point on the J axis
 - outward around a point on the J axis
 - inward around a point on the I axis
 - outward around a point on the I axis
14. If the consumer chooses the combination of goods I and J represented by point E, then the consumer could
- obtain more goods with the available money income
 - not obtain more goods with the available money income
 - shift the budget line outward so that it is tangent with point C
 - shift the budget line inward so that it is tangent with point E
15. In indifference curve analysis, the consumer will be in equilibrium at the point where the
- indifference curve is concave to the origin
 - budget line crosses the vertical axis
 - two indifference curves intersect and are tangent to the budget line
 - budget line is tangent to an indifference curve
16. If a consumer is initially in equilibrium, a decrease in money income will
- move the consumer to a new equilibrium on a lower indifference curve
 - move the consumer to a new equilibrium on a higher indifference curve
 - make the slope of the consumer's indifference curves steeper
 - have no effect on the equilibrium position

Questions 17, 18, 19, and 20 are based on the following graph.



17. If the budget line shifts from BL #1 to BL #2, it is because the price of

- (a) K increased
- (b) K decreased
- (c) L increased
- (d) L decreased

18. If the budget line shifts from BL #2 to BL #1, it is because the price of

- (a) K increased
- (b) K decreased
- (c) L increased
- (d) L decreased

19. When the budget line shifts from BL #2 to BL #1, the consumer will buy

- (a) more of K and L
- (b) less of K and L
- (c) more of K and less of L
- (d) less of K and more of L

20. Point C on indifference curve IC #3 can be an attainable combination of products K and L , if

- (a) the price of K increases
- (b) the price of L increases
- (c) money income increases
- (d) money income decreases

PROBLEMS

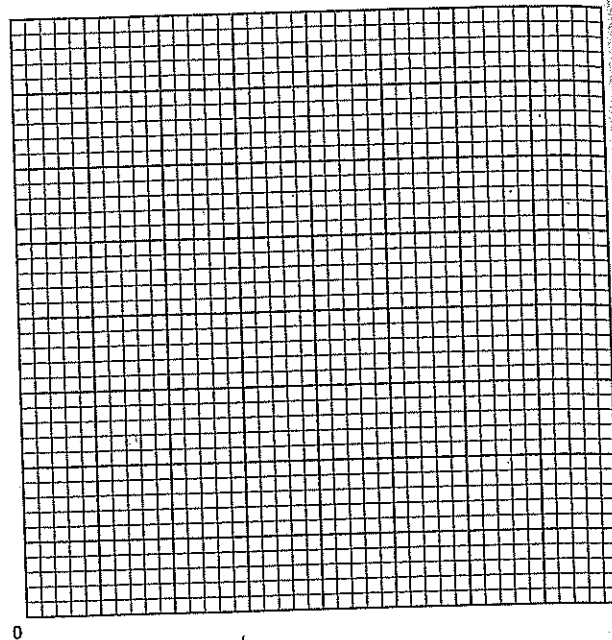
1. Following are the schedules for three indifference curves.

Indifference schedule 1		Indifference schedule 2		Indifference schedule 3	
A	B	A	B	A	B
1	28	0	36	0	45
2	21	1	28	1	36
3	15	2	21	2	28
4	10	3	15	3	21
5	6	4	11	4	15
6	3	5	7	5	10
7	1	6	4	6	6
	0	7	1	7	3
			0	8	1
				9	0

a. On the graph in the next column, measure quantities of A along the horizontal axis (from 0 to 9) and quantities of B along the vertical axis (from 0 to 45).

- (1) Plot the 8 combinations of A and B from indifference schedule 1 and draw through the 8 points a curve which is in no place a straight line. Label this curve IC #1.
- (2) Do the same for the 9 points in indifference schedule 2 and label it IC #2.
- (3) Repeat the process for the 10 points in indifference schedule 3 and label the curve IC #3.

b. Assume the price of A is \$12, the price of B is \$2.40, and a consumer has an income of \$72.



(1) Complete the following table to show the quantities of A and B this consumer is able to purchase.

A	B
0	_____
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____

(2) Plot this budget line on the graph you completed in part a.

(3) This budget line has a slope equal to _____.
c. To obtain the greatest satisfaction or utility from his income of \$72 this consumer will

- (1) purchase _____ units of A and _____ of B ;
- (2) and spend _____ \$ on A and \$ _____ on B .

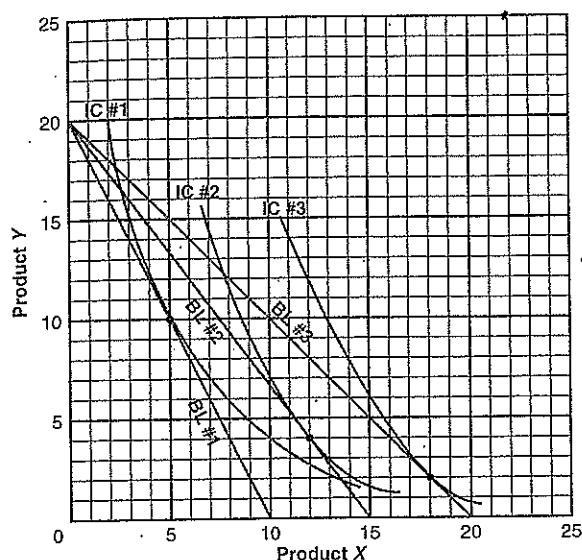
2. Following is a graph with three indifference curves and three budget lines. This consumer has an income of \$100, and the price of Y remains constant at \$5.

a. When the price of X is \$10, the consumer's budget line is BL #1 and the consumer

- (1) purchases _____ X and _____ Y ;
- (2) and spends \$ _____ on X and \$ _____ on Y .

b. If the price of X is \$6, $2/3$ the budget line is BL #2 and the consumer

- (1) purchases _____ X and _____ Y ;
- (2) and spends \$ _____ for X and \$ _____ for Y .

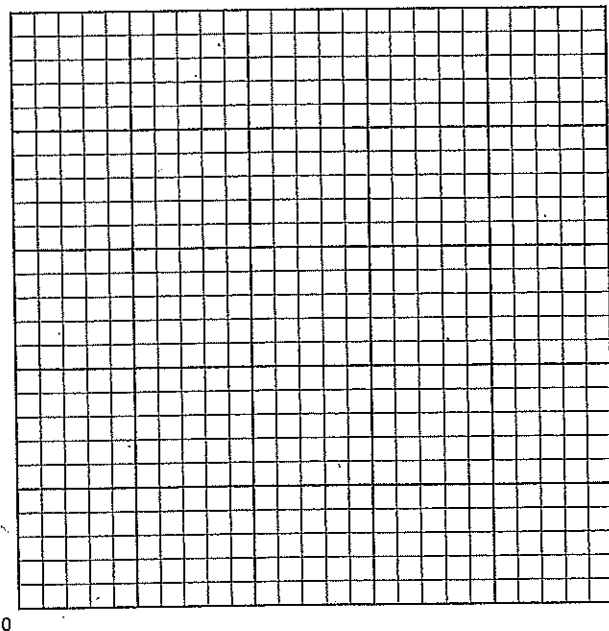


c. And when the price of X is \$5, the consumer has budget line BL #3 and

(1) buys _____ X and _____ Y ; and

(2) spends \$_____ on X and \$_____ on Y .

d. On the following graph, plot the quantities of X demanded at the three prices.



e. Between \$10 and \$5 this consumer's demand for X is (elastic, inelastic) _____, and for him products X and Y are (substitutes, complements) _____.

SHORT ANSWER AND ESSAY QUESTIONS

- Why is the slope of the budget line negative?
- How will each of the following events affect the budget line?
 - a decrease in the money income of the consumer
 - an increase in the prices of both products
 - a decrease in the price of one of the products
- Explain why the budget line can be called "objective" and an indifference curve "subjective."
- What is the relationship between an indifference curve and total utility? Between an indifference map and total utility?
- Why is the slope of an indifference curve negative and convex to the origin?
- You are given two products, alpha and beta. Why will the utility-maximizing combination of the two products be the one lying on the highest attainable indifference curve?
- Suppose a consumer purchases a combination of two products that is on her budget line but the budget line is not tangent to an indifference curve at that point. Of which product should the consumer buy more, and of which should she buy less? Why?
- What is the important difference between the marginal-utility theory and the indifference-curve theory of consumer demand in terms of how utility is considered or measured?
- Explain how the indifference map of a consumer and the budget line are utilized to derive the consumer's demand for one of the products. In deriving demand, what is varied and what is held constant?
- How does a change in the price of one product shift the budget line and determine a new equilibrium point? Explain and illustrate with a graph.

ANSWERS

Appendix to Chapter 7 Indifference Curve Analysis

FILL-IN QUESTIONS

- income, a budget
- price of X , price of Y
- right, left
- inward, outward, B
- An indifference, utility
- downward, convex
- marginal
- greater, decreases
- total, map
- greater
- tangent, slope
- up
- cardinal, ordinal
- a. outward, right; b. higher; c. more
- demand

TRUE-FALSE QUESTIONS

- | | | |
|-------------------|-------------------|--------------------|
| 1. T, pp. 147-148 | 6. F, pp. 148-149 | 11. F, p. 150 |
| 2. F, pp. 147-148 | 7. T, p. 149 | 12. T, p. 150 |
| 3. F, pp. 147-148 | 8. T, pp. 149-150 | 13. T, p. 150 |
| 4. T, p. 148 | 9. F, pp. 149-150 | 14. T, p. 150 |
| 5. T, p. 148 | 10. F, p. 149 | 15. T, pp. 150-151 |

MULTIPLE-CHOICE QUESTIONS

- | | | |
|-------------------|--------------------|---------------------|
| 1. d, pp. 147-148 | 8. c, pp. 148-149 | 15. d, p. 150 |
| 2. b, pp. 147-148 | 9. b, p. 149 | 16. a, pp. 148, 150 |
| 3. b, pp. 147-148 | 10. c, pp. 148-149 | 17. b, pp. 151-152 |
| 4. b, p. 148 | 11. c, pp. 149-150 | 18. a, pp. 151-152 |
| 5. b, p. 148 | 12. b, pp. 149-150 | 19. b, pp. 151-152 |
| 6. c, p. 148 | 13. a, p. 150 | 20. c, pp. 148, 150 |
| 7. d, pp. 148-149 | 14. a, pp. 149-150 | |

PROBLEMS

1. a. graph; b. (1) 30, 25, 20, 15, 10, 5, 0, (2) graph, (3) -5; c. (1) 3, 15, (2) 36, 36
 2. a. (1) 5, 10, (2) 50, 50; b. (1) 12, 4, (2) 80, 20; c. (1) 18, 2, (2) 90, 10; d. graph; e. elastic, substitutes

SHORT ANSWER AND ESSAY QUESTIONS

- | | | |
|----------------|----------------|-----------------|
| 1. pp. 147-148 | 5. pp. 148-149 | 9. pp. 151-152 |
| 2. p. 148 | 6. p. 150 | 10. pp. 151-152 |
| 3. pp. 147-148 | 7. p. 150 | |
| 4. pp. 148-150 | 8. pp. 150-151 | |

